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GLACIAL AND NORMAL EROSION IN MONTANA AND WISCONSIN*

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Introduction.—The borders of glaciated regions, if well defined, are interesting because they present in juxtaposition two strikingly different types of topography—the glaciated and the unglaciated. The writer has recently visited two such places, namely, the Crazy Mountains of Montana, where local Alpine glaciation has occurred, and Baraboo, Wisconsin, which lies near the terminal moraine of the Wisconsin glacier, the latest of the continental ice sheets of the Glacial Period. The glacial features of the latter region are well known through the writings of Professors Salisbury and Atwood† and others. Glaciation in the Crazy Mountains, however, has received scant attention in the published reports. In this paper are presented brief accounts of these regions, together with some remarks on the characteristics of glaciated as contrasted with unglaciated surfaces.

So far as the physiographic development of any country is concerned, the advent of glaciers or ice sheets may be considered as an accident which interrupts for a time the processes of normal erosion and modifies to a greater or less extent the products of the latter. The surface just without the area covered by ice shows at what stage in the process the interruption occurred. In locally glaciated areas, such as the Crazy Mountains, the glaciers were mainly of the valley or Alpine type, so that surfaces unaffected by them may be found all the way from below the terminal moraines up the slopes of the mountains, above the glacial troughs, even to the very ridges. In regions of continental glaciation, like the country formerly

*The writer is indebted to Professor W. M. Davis for helpful suggestions.

†The Geography of the Region about Devil's Lake and the Dalles of the Wisconsin. Wis. Geol. and Nat. Hist. Survey, Bull. V, Educational Ser. I, 1900.

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covered by the Wisconsin ice sheet, the ice over-rode both ridges and valleys so that unglaciated areas are found only beyond the terminal moraine. The control of pre-glacial topography has thus been far greater in the locally glaciated fields than in the territory formerly occupied by the great ice sheets.

The Crazy Mountains.—The Crazy Mountains occupy an oval area 40 miles north and south and 15 to 20 miles east and west in south central Montana, about 60 miles north of the Yellowstone National Park. They are nearly cut through by the headwater basin of the Shields River and divided into two parts, the north and the south. The southern section is larger, higher and more rugged. In the northern section the highest elevations have broad, smooth and nearly flat or dome-like surfaces that truncate gently upturned strata and igneous intrusives alike. Loco Mountain, the best example, is a low dome whose summit is an area, almost flat, three or four miles long and one or two miles wide, with an altitude of about 9,000 feet. This area, though stony with weathered blocks of eruptives and metamorphosed sediments, is yet covered with sufficient grass and weeds to support a band of 2,000 or 3,000 sheep for a large part of the summer. The highest peak forms a gentle knoll about 200 feet above the general level. Later glacial and stream erosion has cut sharply into Loco Mountain, but the smooth outlines may be followed down the divides to the gentle foot slopes, remnants of which now form the beautiful benches that slope away from the mountain at an angle of about five degrees, and lie 200 feet or more above the present stream courses.

In the southern section of the mountains a similar, but smaller, upland remnant is found at an elevation of 10,000 feet, while the neighboring sharply serrate ridges rise to accordant heights and indicate a similar but larger dome whose sides descend to gently sloping benches, as in the northern section. Here, again, later erosion has cut sharply into the older topography and produced the rugged features now seen. Outside the mountains there are at least two well-defined sets of rock benches lower than those just mentioned. The different erosion periods thus suggested are not so clearly shown within the mountains.

At the time the surface represented by the highest benches was formed, the Crazy Mountains must have had in their higher portions an elevation of between 3,000 and 4,000 feet above the surrounding country, on account of the very resistant character of the intrusive and metamorphosed rocks of the mounains, compared with the relatively weak and poorly consolidated sediments of the neighboring region. Notwithstanding this difference in elevation, the gentle character of the older topography, together with the

fact that it truncates various kinds of rocks and rock structures, indicates that an advanced stage of physiographic development had been reached, probably early old age. The valley heads were doubtless broadly open with gently sloping sides. The rivers meandered widely in broad flood plains. The spurs of the valley sides were cut away and divides were lowered. Outside the mountains, where the strata are more nearly flat, isolated buttes or tables, capped by remnants of intrusive sheets or resistant strata, bear witness to the advanced age attained during that period.

Subsequently the region was elevated and the streams revived. The lower rock benches above mentioned indicate that there were at least two well-defined periods of erosion before the present one. The earlier of these appears to have reached a late mature stage, while the later one was somewhat less advanced. In the present cycle outside the mountains all the larger streams have developed broad flood plains, but many of the smaller ones are not yet graded.

There is some evidence that the glaciation was more recent than the later of the lower benches mentioned. The snow and ice gradually scooped out the valley heads and produced the steep-sided cirques that cut farther and farther back into the divides and formed the sharp arrêtes so common in the southern section of the mountains (Fig. 1). Many of the cirques are perfectly developed, but there are others less well formed, and in the zone just above the benches there are cases where the valley heads are only slightly modified by ice and snow. The scouring of the cirque floors made depressions, which in many cases were occupied by lakelets when the ice withdrew. The ice streams found the valleys imperfectly adapted to their purpose and hence deepened them and made their sides steeper, thus transforming their lower portions into broad U-shaped troughs.

In both glaciers and rivers the surfaces of the various branches join those of the main streams at grade, while the channel floors, being cut less deeply, enter the sides of the main troughs at a height above the bottom depending upon the relative sizes of main stream and tributary. In the case of rivers, when the channels are laid bare, this hanging relation of the side valley is inconspicuous and may readily escape notice. In the case of glaciers the trough forms so much greater a proportion of the whole valley that the side valleys may frequently hang at heights of several hundred or even thousand feet above the floors of the main troughs. This feature is found in all the larger cañons of the Crazy Mountains. Well-known examples of it occur in Norway and in the Alps. In fact, hanging lateral valleys are characteristic of all glaciated mountain regions (Fig. 2).

In the upper parts of the cañons, where the rocks are hard, bare ledges

are exposed with beautifully striated surfaces. Long slopes of normal erosion rise 2,000 to 3,000 feet above the tops of the glacial troughs to the divides, which, for the most part, have not been glaciated. In the lower cañons, where the rocks are weak, the troughs constitute nearly, or quite, the entire valley and have been filled to a considerable depth with glacial débris, so that it is difficult to tell how deep they really are. The contact zone between the hard rocks of the interior of the mountains and the weaker rocks outside is marked by a break in grade in all the cañons that the ice did not efface and that is now a region of cascades. Applying the idea of the erosion cycle to the glaciation of the Crazy Mountains, it may be said that a stage of middle or late youth had been reached at the time when the activity of the ice waned. The main glaciers had not graded the more resistant portions of their trough floors, while the cirques had not developed sufficiently to control the character of the divides. The effect of glacial occupation on the drainage pattern of the Crazy Mountains has been to deepen, to some extent at least, the main valleys and to steepen their sides, and to substitute for the system of digitate branches, without lakelets or falls, a number of hanging valleys and cirques with many lakelets and cascades.

The morainic filling covers the valley floors, and, where the cañon walls become lower, overspreads the neighboring benches. The rolling morainic surface, suggestively called "knob and kettle" or "sag and swell" topography, with occasional ponds or moist areas in the hollows, forms a marked contrast to the even and gently descending slopes that occur everywhere outside the moraines (Fig. 3). The stony surface of the latter, covered with blocks of many kinds of rock, makes travel harder for the horses than the gravel-covered slopes of the unglaciated benches, whose only roughness is produced by the occasional outcrop of intrusives or hard strata and the loosened and weathered blocks from those sources. The finer materials washed from the glaciers were deposited in the valleys outside the cañons.

Two or three tiny glaciers (Fig. 1) still remain in the larger cañons, but the ice has practically withdrawn from the mountains. Postglacial erosion has accomplished little in the way of readjustment of drainage conditions. The cascades in the upper cañons have done little more than notch the rims of the hanging valleys from which they leap. The lakelets in the cirques remain unfilled and undrained. The swift torrents in the main cañons have not succeeded, in the majority of cases, in cutting through the glacial fillings, except near their lower ends. The moraines in the lower valleys and on the benches have been essentially untouched. Some progress has, however, been made in weathering back the steep sides of the glacial

troughs and cirques and in the accumulation of talus material. On the whole the stage of development attained since the departure of the ice is highly youthful.

The Baraboo Region.—The city of Baraboo, Wisconsin, lies just to the east of the well-known Driftless Area of southwestern Wisconsin. This region, though well within the general territory occupied by ice, escaped

Fig. 1. Head of Big Timber Creek, showing cirque and arrête topography, small glacier, and lakelet

glaciation by any of the great ice sheets because it lay to the south of the highlands that separated the great ice lobes that occupied Lakes Michigan and Superior. The glacial lobes did not reunite until the latitude of northern Iowa was reached. The east boundary of the Driftless Area is formed by the terminal moraine of the Wisconsin ice sheet, which, being least affected by secular decay and erosion, is the most recent of the great continental glaciers. This boundary is therefore more distinctly marked than the others formed by earlier glaciers.

The Driftless Area has been unaffected by stream wash from the ice, except in the case of the Wisconsin River, which has developed fluviatile plains of water-worn glacial material. There has been, too, near the

former ice front, some development of marginal lakes, as indicated by appropriate deposits. The surface features of the region are quite distinct from those of the neighboring glaciated country. The nearly flat rocks have been deeply weathered and the products formed thereby make the overlying soils. The more or less disintegrated rock fragments are all of the same kind as the strata beneath. The rivers have the intimately branching and

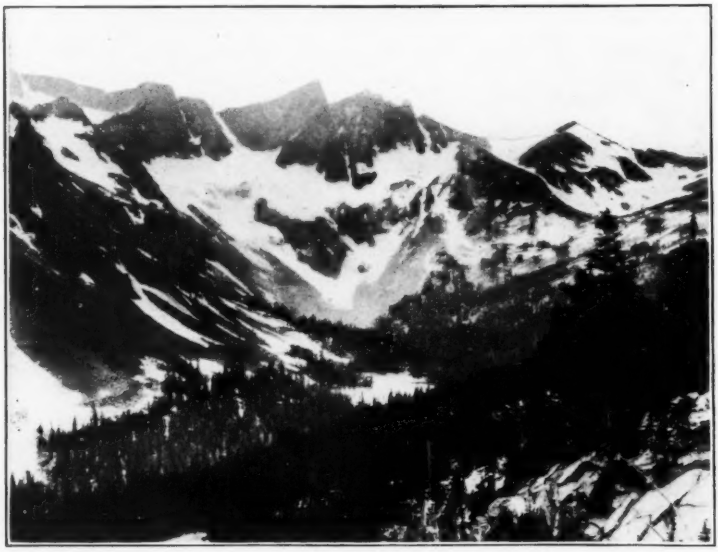

Fig. 2. Hanging valley on the south side of Big Timber Creek near the head (Crazy Mountains)

sub-branching pattern known as *insequent,* in distinction from those streams that follow the guidance of initial slope—called *consequent,* or those that have developed along weak geological structures—called *subsequent.* The uplands are well dissected or separated into numerous more or less distinct areas of similar altitude, that serve as divides between the larger streams, and send off lateral spurs as subdivides for the minor streams. No lakes occur, except such as have been produced artificially. The larger rivers have developed broad flood plains and most of the smaller tributaries have reached grade. Above the general level of the uplands rise isolated masses of horizontally stratified rock, whose tops, reaching accordant heights, form remnants of a still higher surface that indicates an earlier period of base-

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Fig. 3. Valley of Swamp Creek in the Crazy Mountains, looking southeast, showing upper benches and morainic deposits of the former glacier

leveling. The Driftless Area may therefore be described as in a late mature stage of development, succeeding old age of a previous cycle. In such an area the drainage is well adjusted to the quantity of water and rock waste that must be disposed of. There is no unnecessary haste in falls or rapids, nor delay in ponds, but instead a continuous downward and outward movement of water and waste toward the sea.

At the beginning of the Glacial Period the territory now glaciated must have been very similar in its character and stage of development to that of the present Driftless Area, so that the occurrence of the two regions side by side affords a striking contrast. The ice overspread both uplands and valleys, and its great thickness and weight gave it intense scouring power. The weathered mantle rock was removed and transported farther southward. Uplands were scoured off and lowlands were filled in with material derived partly from other sources farther north, and there was, on the whole, a general tendency to level off the surface. Wherever the ice front lingered for any length of time belts of rather thicker deposit were formed. Since the ice front had many minor variations of position and form in any halting place, these morainic belts or terminal moraines have variable width and irregular surfaces. The latter, instead of being ridge-like, are composed of great numbers of small, rounded or oval hills, usually not exceeding 30 or 40 feet in height, accompanied by hollows of greater or less extent, without outlet, and sometimes occupied by ponds or swampy areas.

The terminal moraine west of Baraboo varies in width from about half a mile to nearly a mile, and is slightly higher than the land on either side. Its eastern margin is not well defined, but from the west it appears as a fairly distinct ridge 30 feet or more high.

Within the glaciated area the bed rocks are covered with transported soil, consisting, in part at least, of foreign materials, and the underlying rock surfaces, where exposed, are relatively fresh, in strong contrast to the native soil and deeply disintegrated rocks of the Driftless Area. The well dissected upland has been replaced by a wide tract of land with somewhat uneven and generally uncut surface. The many well-developed insequent streams have given place to a few sluggish rivers or creeks that wander about among extensive marshes and connect numerous ponds. Instead of deeply cut, graded valleys, with no falls, rapids or lakes, the streams now lie in shallow valleys and have done little cutting. Falls occur here and there, as some displaced river comes upon a buried ledge, and lakes and swamps cover wide areas.

KHIRGHIZ NOMADS AND THE INFLUENCE OF THE HIGH PLATEAUS

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THE great physical difference between the plateaus and the floor of the Lop basin has notable consequences in the diverse human habits and character of the two regions. Apparently, the physical differences are the cause of the human differences. In order to take the first step in bringing out this geographic contrast between the human inhabitants of the two diverse regions, I shall postpone the account of our journey from the Sanju pass down to the zone of vegetation, and shall devote this chapter to a description of the Khirghiz, a race of Mohammedan nomads inhabiting the high plateaus. As the Karakorum plateau is for the most part too high and cold to be inhabited, we saw but a few score Khirghiz on the way from India to Turkestan. In the summer of 1903, however, as a member of the Pumpelly Expedition of the Carnegie Institution, I spent three months among the Khirghiz of the plateaus to the west and southwest of the Lop basin, chiefly in the western and central part of the Tian Shan plateau. During a residence in Turkey I had learned a little Turkish; and now I found that I was soon able to pick up enough of the Khirghiz dialect of Turki, a language very closely allied to Turkish, to dispense with an interpreter in all ordinary matters. A little knowledge of their language went far to put me on terms of comparative intimacy with my Khirghiz servants, and facilitated a very pleasant acquaintance with many of the people whom we met.

Wherever I have found the Khirghiz living unrestrictedly under their normal nomadic conditions among the mountains, whether north, west, or south of the Lop basin, they appear to have essentially the same habits and character. So far as I can learn, the Indo-European nomads to the west of the Lop basin in Wakkan and Sarikol, and the Mongol nomads of Buddhist faith to the east in northern Tibet and eastern Tian Shan, all of whom live under physical conditions similar to those of the Turanian Khirghiz, have very similar habits and character in spite of differences in race and religion. This suggests that environment is in this case more potent than either race or religion in determining habits and even character, provided, of course, that the environment is operative long enough. In the following chapters it will be interesting to inquire how far the specific habits and characteristics mentioned are best explained as the product of physical environment, according to the hypothesis of this book, and how far

they are the result of other and less easily defined causes not here considered.

The typical part of the Tian Shan plateau which I visited in 1903 lies between Andizhan on the west, Issik Kul (Warm Lake) on the north, and Kashgar on the south. The main physiographic feature of this western Tian Shan region, as of the Karakorum, is that the so-called mountain system is in reality an area of low relief which has been uplifted to a great height, forming a broad plateau. The uplift was accompanied by warping, which has divided the plateau into a series of basins and rolling ridges or uplands, none of which are as yet extensively dissected by the rejuvenated rivers, whose grade and consequent power of dissection were greatly increased by the change of level. Thus a large part of the western Tian Shan region consists of smoothly floored basins and gently rolling uplands lying at a height of from 10,000 to 12,000 feet above the sea, and therefore subjected to relatively heavy precipitation in summer. The conditions of climate among these "pamirs," as they are generically called according to Younghusband, allow an abundant growth of thick, turfy grass full of flowers. Trees, however, are wholly absent on the main plateau, and are rare even on the lower slopes. Schimper explains this as due to the fact that the wet season in midsummer is not long enough to favor the growth of trees, which require a growing season much longer than that of grass. Nevertheless, in the valleys, at an elevation of from six to nine thousand feet, there are some trees and a profusion of delicate flowers, rich grass and shrubs.

It is not my purpose to discuss the vegetation. It may be worth while, however, to print here a list of the plants, so far as I happened to record them, which grow wild among the lower slopes of the mountains northeast of the Lop basin, but are cultivated in Europe and America. They comprise the apple, apricot, plum and olive (not the commercial species); the asparagus, onion and rhubarb; the candytuft, chrysanthemum, crocus, heliotrope, peony, phlox and tulip; the large blue and purple varieties of columbine; the pansy and lady's delight, both purple and yellow; and the red, yellow and white varieties of the poppy and rose. That there are many more than these nineteen species I am well aware, but those mentioned are enough to show the general character. The names of the plants were originally recorded with no thought of their possible significance. The list is of interest in view of the much controverted theory that Central Asia was the original home of the chief races of Europe. So far as it goes it supports the theory; for it suggests that the original migrants from Central Asia carried with them plants which there grow wild, and which have since been cultivated in the new lands where the wanderers finally settled.

Returning to our main subject, the first and most important geographic feature of the Tian Shan plateau is, as we have seen, the pamirs, or plains of rich grass. They determine the character of animal life, including man. The climate is so cold, and snow lasts so long, that animals can not permanently inhabit the plateau in great numbers, unless they hibernate like the innumerable marmots, or migrate like birds; and even the latter can not find food easily because of the scarcity of insects and of weeds with large seeds. Yet during the summer months the conditions are almost ideal for herbivorous species of animals. Man can easily turn this fact to his advantage, provided he adopts the habit of permanent nomadism. The rich, grassy uplands are capable of fattening millions of sheep and cattle during the summer; but before the winter snow sets in the flocks must be driven many days' journey down to the dry, open plains, or to protected valleys, in either of which places the animals find poor picking compared to their rich summer pasture. The Khirghiz shepherd must change his residence at least twice a year. His family must go with him. All the men are needed to care for the flocks, and it would not be safe to leave the women and children far away in the valleys. Moreover, if they were left, they would have nothing to do, for there is practically no opportunity for agriculture, and the only work to be done in summer at the winter quarters is to cut a little grass for winter use. Some of the poorer families are sent down for a few weeks in July or August to do this. As a matter of fact, the shepherds move their dwellings much oftener than twice a year, for the best pasture is found close below the ever-shifting snow-line. It takes but a few weeks to eat up the finest grass near to the tents, and then, either the camp must be moved or the flocks driven farther. Again, as the animals are brought close to the encampment at night, the ground soon becomes foul, especially during the rainy weather of summer, when there is no chance for it to dry. Thus, by force of physical environment, nomadism is the only condition under which human occupation of most of the Tian Shan plateau is possible.

This being so, it is easy to see that the necessity for frequent migrations becomes the main fact in the lives of the Khirghiz, and determines all manner of habits and customs. For instance, dwellings must be such that they can be easily carried from place to place. All men, whether rich or poor, must move equally often, and even the richest can not have a very large or ostentatious habitation. The materials for houses are willow sticks and woolen cloth, because these are the most easily available. The round tent is thick and tight in order to withstand heavy rain and snow. It has in the roof a large, round hole, capable of being covered with a felt, but

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oftener left open to allow the escape of the pungent smoke of dried dung which forms the only available fuel. The most salient feature of the dwelling, however, is the ease with which it can be taken to pieces and moved from place to place; hence its peculiar appearance and mode of construction, which are more evident from the accompanying photographs than from any description. No iron is used; the lattice work, made of pieces of willow an inch in diameter, is bound together by strips of rawhide drawn through holes, while the poles which support the roof are tied in place with homemade ropes of wool. Large felts cover the outside, the lower part of which is sometimes adorned and protected by matting made of reeds a quarter of an inch thick and four feet long, tied so as to stand vertically. The whole dwelling can be folded compactly into pieces of convenient size for carriage by camels or oxen whenever a migration is to take place.

In similar fashion the furniture of a "kibitka," as the tents are called, is of peculiar sort, corresponding to the materials at the disposal of the Khirghiz, and to the necessity of easy transportation. Utensils are made chiefly of leather and wood, the most available materials which will not break. Again, the dress of the Khirghiz is adapted to the coolness and dampness of the climatic conditions under which the people live. Having described these things, we at once perceive that they in turn limit the æsthetic sense of the Khirghiz. These people can not know much about architecture or the ceramic art; but they can and do enjoy bright-colored rugs and felts, gaudy leather boxes, gay screens or hanging doorways, and gorgeous robes or delicately embroidered headdresses for the women. The designs which the people employ are for the most part simple and highly characteristic. The environment of the Khirghiz limits and controls, but by no means stifles, the æsthetic sense.

A description of some of the events of two days in early July, 1903, when Professor Davis and I traveled from the Narin River up to Son Kul (Left-hand Lake), will illustrate some of the points already mentioned, and will give an idea of the daily life of the people. From the ford of the Narin River, an easy ride up a pretty mountain valley brought us to a group of kibitkas, set in a green amphitheater surrounded by steep walls of gray limestone. An unusually neat kibitka, so new as to be still white, was evidently being prepared for us at the suggestion of the Khirghiz guide, who, of his own accord, had ridden ahead to see that all was ready for our reception. The kibitka had been picked up bodily, and, as we approached, was being carried to a cleaner spot away from the unpleasant neighborhood of the other kibitkas and of the flocks and herds. A dozen men and women

had gone inside and picked up the kibitka by the lattice-work fence. Under the direction of a man on the outside, who acted as eyes for the rest, they were carrying it blindly to the designated spot. It looked like an enormous beetle walking across the turf with a dozen pairs of human legs. The household goods which the kibitka had sheltered—the piles of rugs, felts, quilts, skins, boxes, bags, wooden bowls and leather buckets—were left exposed in a sorry heap, which the women good-naturedly removed to another tent.

In the evening our Khirghiz village was in perfect order. Ten or fifteen kibitkas were scattered on a fair green slope between the steep, gray cliffs. On one side hundreds of stupid sheep were trying to push their way into the center of the flock; on the other, herds of neighing, kicking horses, fat mares and frisky colts were interspersed with stolid cattle and with camels—awkward, two-humped beasts, strangely out of place among the lofty mountains, and ridiculous in felt coats put on to keep them warm and, especially, dry. In the morning the village was in dire confusion. Kibitkas were lying in pieces on the ground with household goods strewn around them. A migration was to take place, and men, women and children were busily making preparations. The slow-moving, pattering flocks of sheep had already been sent away at dawn, but the rest of the animals disported themselves among the ruins of the tents, waiting to be packed or ridden.

The men of the community were clad in big top-boots, black conical hats of heavy felt with brims of Astrakhan, and long, quilted, cotton gowns which had been wet so often as to appear dark and oily. Their chief business seemed to be to load the animals, or to catch those which were still loose. When a horse was to be caught, a man seized a pole like a fishing-rod with a loop of rope at the end, and jumped bareback on another horse which was already bridled. Violent kicking and lusty shouting started both horses into a fine gallop, and it was sometimes half an hour before the loop was thrown over the animal's head.

The women wore heavy boots and quilted gowns much like those of the men. Many, however, had taken off the outer garment and were dressed in loose gowns of white cotton, or, in the case of the rich, of gorgeous silk, red, purple and yellow. The sleeves of the garments of both sexes extended five or six inches below the hands, and took the place of gloves as a protection against cold, especially in riding horseback. The headdresses of the women, often a foot high, were wonderfully constructed of fold after fold of white cloth wound into a cylinder. One fold hung over the ears and under the chin in such a way that it could be drawn up over the lower

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part of the face, although this was rarely done. From below the huge headdress the black hair hung in silver-studded braids, pieced out with cords or strings of leather. At the ends of the braids, one or two silver roubles and the keys of all the family chests dangled close to the women's heels.

When one of the kibitkas had been tied up ready for packing, a tiny girl of six led up a camel ten feet high, and in spite of the creature's horrible grunts and roars, made it kneel meekly by twitching the rope fastened to a stick in its nose. The largest, finest camel was adorned with a long, red fringe, which hung over the saddle and over the animal's long, curved neck to its head. When two men had tied a load of pots, pans, boxes, felts and parts of a kibitka securely to the camel, I saw a silk-gowned mother lay her baby in a wooden cradle without rockers. After covering it well, she tied one rope over its legs and around the cradle, and a second over its chest. Then, in spite of its lusty crying, she lifted the cradle unconcernedly to the top of the load of the kneeling camel, lashed it on, and covered both baby and load with a large rug. She did not mean to neglect her baby, but though she was one of the richest women of the community, she, like every one else, had to work that day. Cradles of the sort in which this mother laid her child figured sadly in a scene which I saw later. Out on a lonely hilltop among the great mountains we came upon a group of graves. Beside each of the six smallest heaps of earth there stood an empty, weather-beaten cradle.

Camels were not the only baggage animals that morning. Horses are esteemed too highly to be often burdened with loads, but frequently we saw a man on one side of a stout ox and a woman on the other, each with the right foot braced against the animal's side while they drew taut the ropes which bound the load of kibitka poles. A monkey-faced dog slunk behind one such pair, while close by a girl of ten in figured red and purple silk waited to be helped on to her horse. Beside her a tiny imp of three stood motionless; his round, astonished face, long gray dress, and boots so high that he could not bend his knees, all sunk into insignificance under the immense dome of his black sheep-skin hat. Even he could ride a horse, as we soon saw.

At last, when all was ready, we started on a delightful ride up a steep gorge. The road zigzagged among fine spruces, almost the only ones that we saw in Central Asia. We passed first a man on a cow, then a heavily loaded camel with two small boys perched high on top of the load, and two ridiculous baby camels, too small to carry even a roll of felts, running awkwardly in the rear. Next two fat cows with wooden rings in their

noses walked placidly along with loads of straw matting and poles. In front of them an old gray-beard with a black hat and a wadded gown rode proudly on a spirited horse. His gloved right hand rested in a wooden crotch at the upper end of a short stick which stood in a little stirrup, and on his wrist perched a hunting-eagle with a leather hood over its eyes. Behind the man a four-year-old urchin, a miniature of his grandfather, planted his feet sturdily on the horse, while his hands firmly grasped the old man's shoulders. Ahead of this pair a ragged lad, mounted bareback on a yearling steer, jogged along contentedly behind a herd of horses and colts. In spite of his rags he looked happy, well-fed and warm. So, too, did all the people on that day's march; and, indeed, all the pastoral nomads whom I have ever met seemed to be comfortable. When their flocks diminish and they grow poor they are obliged to seek new homes and to betake themselves to agriculture, leaving only the rich to continue the nomadic life.

As might be expected from their surroundings, the food of the Khirghiz is very limited in variety, and is eaten in the simplest way. A typical meal, such as one in which I shared and many at which I was a spectator, is likely to prove unpleasant to civilized nerves. One day, as I sat cross-legged within a circle of Khirghiz on the gay felts which carpeted most of the floor of a rich kibitka, our host came in, holding up the skirt of his gown full of dried dung. With this he kindled a pungently smoky fire on the stones in the middle of the kibitka floor, and on the flameless conflagration put some tea to boil. When this began to simmer he took from the lattice-work of the kibitka a cloth, heavy with grease and dirt, and spread it before me, questioning the entire circle meanwhile as to the advisability of serving cream with the tea. After much discussion a boy was sent to fetch both milk and cream, while the host placed on the dirty cloth a metal tray containing small pieces of bread and sugar. The bread was in the form of cubes half an inch in diameter, such as I had seen the plump, red-cheeked women cooking like doughnuts in hot fat at the bottom of enormous iron bowls, the sole cooking utensils. Among the strictest nomads bread is a great rarity, and I have had the pleasure of giving a piece to children who had never tasted it before. After the tray was in place, our host took some china bowls from their nest in a round, wooden box, and having wiped them with another greasy cloth, filled them with tea. By the time this had cooled, the boy returned with news that his quest had been successful. At his heels followed a fat Khirghiz housewife who dived into the small woman's sanctum behind the ornamented screen of reeds, which invariably stands on the right as one enters the door, and

with a wooden ladle scooped almost solid cream from a large, wooden bowl into a small, china one, and then poured milk from a leather flask into another smaller, wooden bowl. As she handed the milk and cream to one of the men, she saw that bread was needed on the tray. Kneeling before a red and green leather-covered box, she reached behind her heels for the silver-loaded bunch of keys suspended from her long braid of straight, black hair, and, finding the proper key, took from its safe repository a handful of carefully treasured bread. Now the tea-drinking began, and it continued till the supply was exhausted. Each guest had three or four bowls, but even that was not enough, so each one finished with a wooden bowl of "kumiss," the fermented milk that still remains one of the most important articles of Khirghiz diet. Then when the servants had smacked their lips over the remains of the meal, each man, with a look to see that his neighbors were ready, raised his hands to his face, and all in unison stroked their beards, with a muttered prayer to Allah.

During the next hour or two big stories of brave deeds and travel were told, or less praiseworthy talk of quarrels and women kept the party animated at first, but soon the kumiss took effect, and drowsiness began to prevail. At length, to the relief of all, the host appeared, and we knew that the real meal was at hand, for the tea-drinking is, after all, but a new-fangled, Russian notion. In his hand, at the end of a spit, he bore a small piece of roasted fat from the immense kidney-shaped tail of the sheep that we were to eat. Pulling his big knife from his girdle, he cut off morsels and placed one in the mouth of each guest as an appetizer. Behind the host came his boy, bearing a basin and a copper urn of water, from which, in the oriental way, he poured water over the hands of one after another of the squatting circle, beginning, of course, with the foreigner as the most honorable. As the Khirghiz put out their hands to wash, they made a peculiar gesture in throwing back their long sleeves.

The washing over, dinner followed promptly—an enormous quantity of boiled mutton in a huge wooden bowl, flanked by two smaller bowls full of the broth in which the meat had been cooked. The host waved his hand over the bowl and cried, "Eat!" some one else cried, "Eat!" and then each cross-legged Khirghiz cried, "Eat!" and, whipping his knife from his girdle, plunged his hand into the dish. The scene that followed was like the feeding of wild animals in a menagerie. Each man grasped a bone, and with his knife and teeth ripped off huge chunks of meat or fat, and with a mightly sucking and smacking drew them into his mouth. The daintiest portions, the head and liver, were offered to the elders of the feast, who skillfully gouged out an eye and yanked out the tongue. When

the edge of appetite had been appeased with two or three pounds of meat and a pound or two of fat, most of the guests took a drink of the soup, and then, with idly hanging, greasy hands and greedy eyes, watched while the epicure cracked and sucked a bone, and one or two of the more skillful carvers prepared a delicate hash. The fat tail, which is really delicious, a selected portion of the liver, and a good supply of other fat and meat were most cleverly sliced into fine fragments and mixed with soup in the bottom of one of the bowls. When the mixture was ready, each man rolled up a handful and sucked it noisily into his widely distended mouth, or, as a mark of respect and affection, put it into the mouth of his neighbor. The meal was over in an incredibly short time—the last bones were cracked and thrown to the edge of the kibitka; bowls of soup, followed by kumiss, were again passed around; the big topboots were oiled by cleaning the greasy hands upon them; the beards were stroked; and the main business of life was over. Day after day the diet is the same as at this feast, except that the amount of meat is less and of kumiss more. The mutton is occasionally fried or boiled in its own fat, or roasted on a spit. Sometimes a young colt is killed, and is eaten as the greatest of delicacies. The meat, the one time that I ate it, tasted like a cross between the best grades of veal and lamb, and was fit for the table of the most exacting epicure.

Just as the Khirghiz habits of eating are the result of an environment which compels the people to live on animal food, so their hospitality is the result of that same environment which isolates them, and at the same time compels them to travel. Habitations are so often moved that special accommodations for wayfarers do not exist. Yet the nomad, in his search for stray cattle, in his business of exchanging animals, or in his rides between the shifting summer camp and the lower valley where he cuts the winter supply of grass, must often spend the night far from home. Everywhere the people are in the habit of receiving guests, and the custom is to pay nothing for entertainment. In spite of his lonely life, the Khirghiz meets the traveler with less suspicion than does the cosmopolitan villager who lives near a large city. Usually, when I arrived at an encampment, the chief man, who had ridden out a mile or two to meet me, jumped off his horse and gave it to an attendant. Then he led my horse as close as possible to the kibitka which I was to occupy. As I dismounted he put his hand under my shoulder to assist me. When I touched the ground he raised his cap, a habit learned, probably, from the Russians. Then he took my right hand softly between both of his, and finally stroked his beard, suggesting a prayer to Allah. Often when we met strangers on the road they turned and rode with us, to do us honor, and to get the news. The

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isolation of the Khirghiz accounts for their eagerness in this latter respect, and the abundant leisure of the nomadic life accounts for the unconcern with which a man puts off his work for half a day. These chance encounters on the road were often most interesting. One day, as I was crossing the Jukuchak glacier south of Issik Kul, five men appeared on the ice above me, one mounted on an ox, one on a cow, and three on horses, with a loaded camel bringing up the rear. All these five strangers dismounted from their slipping animals and, walking across the treacherous ice, gravely shook hands with me.

Another hospitable Khirghiz habit appears to be a direct result of the nomadic life and the abundance of animals. On entering the main Tian Shan plateau, I found that each day fresh horses were brought for me and my men, and even for our baggage. At first I understood the servants to say that our horses were tired and needed rest, which was true, but when I offered to pay the hire of the supplementary horses, I discovered my mistake. In these regions, it appears, the traveler is theoretically supposed to start from home, and to return thither by the way that he went. The first day he rides his own horse, and at night turns it out to feed with those of his host. In the morning he does not take his own animal, but a fresh one from among those of his host. This he again leaves at night, and so on day after day. On the return journey he picks up at each place the horse that he left there and returns it to its owner. In practice the scheme is not so simple. In our case we were furnished daily with from six to ten horses belonging to various people at the camp where we had spent the night. At the end of the day's march, or occasionally in the middle of the day, we gave up the animals to one or two men who had come with us for the purpose of driving them back. For all this the people would take no pay whatever, though it was often offered. So freely does one man make use of another's horses that not infrequently, when we passed a new herd, some one would say, "My horse is bad," and would dash off to catch another with a fish-pole. I do not know how universal the custom is, but during our journey the changing of horses played so important a part that the stock remark was not about the weather, but "How is your 'animal' to-day? Has he a good gait?"

The sports as well as the labors of the Khirghiz result from the physiographic conditions which induce nomadism. Horses and horseback riding are the one idea of these people, and their greatest sport is the "bagai." I saw this interesting game in the Alai valley, close to the border of Bokhara. As we came down the hillside to the smooth plain, a crowd of distant horsemen seemed to be standing motionless, until one darted out,

and the whole fifty or sixty dashed after him. Evidently they were chasing a leader in some game, and the leader kept changing. Drawing nearer, we saw that two galloping horsemen had detached themselves from the crowd and, as they rode toward us, were struggling for a large, black object bigger than a sheep. Suddenly one of them threw his leg over this, gave it a jerk which nearly dismounted his rival, wheeled his horse to the left, and dashing up to me, threw the thing at my horse's feet. It was a black calf, headless and footless, and partly skinned. At once three or four men who galloped up behind the leader leaned from their moving horses and attempted to pick it up. Two grasped it, twenty or thirty others surrounded them, and all struggled to seize the calf and carry it off. In the *mêlée,* the horses jumped and turned this way and that, while all the riders tried to force a way to the middle of the fight, whipping their own and other people's horses, taking horses by the head and turning them suddenly round, and themselves leaning far out of their saddles as they grabbed madly at the black calf. At last one man captured it, threw it over the front of his saddle, put both legs over it, and was off at a dead run with fifty others after him. They could not catch him, and, making a great sweep as large as the terrace allowed, he returned in triumph to throw the beast before me and get the customary reward.

Then began another scrimmage, in which one over-zealous rider was knocked from his horse and apparently trampled on, but when the kicking, surging crowd of horses had passed, his horse was still with him, and he mounted and galloped off with a grin. After half a dozen scrimmages, one daring rider seized the prize and went over the terrace, down a hundred-foot slope so steep that a footman could scarcely climb it without zigzagging. At the foot the bold rider, hard pressed by his pursuers, cantered across a broad arm of the river, and away across the plain beyond, trying as he went to skin the calf, for he who carries off the skin wins the "bagai."

We rode away with the "Deyem Bai," the giver of the entertainment, who was homeward bound to inspect the cooking of the sheep for the feast that was to follow. It is the custom, I was told, for men of wealth to furnish a goat or calf for the "bagai," and to invite all the men of one or two villages to join in the sport, and at the end to indulge in a feast, or better, a carnivorous orgie. Among the occasions for a "bagai" are a marriage, the birth of a son, the erection of a new kibitka and a death. Possibly this struggle for a dead animal is a relic of the time when the ancestors of the Khirghiz really fought to get the prey from one another. Whatever its origin, it is a wonderful training in horsemanship. For

some reason, no woman is allowed to see the "bagai," or, naturally, to join in the subsequent feast.

The completeness with which Khirghiz life and character are determined by natural surroundings makes the relation between physiography and life far more evident than in the case of more highly civilized people. If the nomad is to be successful, the keenest of eyesight is necessary to detect cattle or encampments at a distance. I was amazed one day to hear my guide say, "Do you see those cattle off there at the foot of the mountain? They are Chinese animals—yaks." After a long search I found them, mere tiny specks of black, so far away that even with a strong field-glass I could barely distinguish them from ordinary cattle. That my guide should recognize them as yaks shows a keenness of sight equal to that of the most skillful hunting tribes of savages. Other Khirghiz showed equal quickness in detecting smoke, kibitkas, men and animals at a distance, so that the trait seems general.

His mode of life makes the Khirghiz able to endure hunger, thirst and fatigue, for these are the necessary accompaniments of long rides in search of strayed cattle. He has no fear of raging fords or slippery passes, and despises the Chanto or Sart of the city who shrinks from crossing a ford where his horse may lose his footing and be washed downstream. In such rough experiences the Khirghiz learns to be self-reliant, and his frequent meeting of strangers under all sorts of circumstances gives him an air of readiness and self-possession. The talk of the Khirghiz is full of roads and travels. If you ask a man how far it is to a certain place he at once begins to tell you all the intermediate stages and their difficulties. These people have the knowledge of their plateau that comes from experience, but book knowledge is very rare. As my escort, a proud, influential Khirghiz, said one day, "Why should the Khirghiz learn to read? It is enough for us to know about sheep and horses and cattle. What more do we want?"

If there were no outside world with which to come in contact, such a view of life might perhaps be wise. As it is, the Khirghiz can not stand against the hard realities of civilization. The coming of the Russians, who now rule most of the native tribes, has done them an immense amount of good in making the country peaceful and safe, and in providing good markets for the products of the flocks. In has also added to their happiness by making such luxuries as tea, sugar, bread and cheap cotton cloth accessible to all, but it will harm them if it leads them to abandon the pastoral life for that of the day laborer. The delightfully gentle and gracious courtesy of the Khirghiz can not offset their laziness, if that term can be properly applied to a quality which is a necessary outcome of the nomadic

life. A nomad is justified in being often idle, for his great exertions at certain times compels him to rest at others, but the qualities so engendered are of no use when steady work is required day after day. Thus it comes to pass that those Khirghiz who have come into close contact with the Russians seem to be deteriorating. Laziness leads to dishonesty, and both tend to insolence and vulgarity. A change of habits, too, causes greater uncleanliness, for customs that may be harmless where a camp is shifted every month or oftener lead to filthiness where a kibitka stays for six months or a year in one place. Change of any kind is always difficult, especially for people like the Khirghiz, who have adapted themselves completely to a type of physiographic conditions so unusual as those of the Tian Shan plateau.

Not only the outward habits of life, but also certain mental and moral qualities of the Khirghiz are due largely, if not entirely, to physical environment. We will now take up one or two among the many subjects where such a relation does not at first sight appear, although I believe that it exists. In determining the mental and moral character of a people, no factor is more important than the position of women, and the resulting character of the homes in which the children grow up. If the position, and hence the character, of women is materially affected by physiographic environment, it follows that a host of other characteristics must be indirectly affected through the tremendous agency of the home and of early training. I freely admit that religion, heredity, tradition and perhaps other unknown factors play an immense part in determining the character of a race, but these, too, in their origin and growth have probably been greatly influenced by physical environment. With that, however, we are not now concerned. It will be enough to point out certain ways in which the physiography of the Tian Shan plateau, working through the institutions of nomadic pastoralism, affects the position of women. If our conclusions are correct, all character is influenced, more or less, by physical environment, and hence is one of the subjects with which geography is concerned.

Mohammedanism, as every one knows, inculcates the seclusion of woman and makes of her nothing but a stupid drudge to do man's work, or a light plaything for his pleasure. Wherever people of Muslim faith gather in towns and cities, as I have seen them in Turkey, Persia, India, Asiatic Russia and Chinese Turkestan, this ideal prevails. In the crowded villages and cities women can do their work behind high, mud walls, and can be confined to certain unseen rooms when male guests visit the house. The support of the family does not depend upon them and their activities

are almost wholly dependent on the will of their husbands. It is but rarely necessary that they should leave the house, and when they do, there is usually no work to be done and it is easy to keep their faces covered. Even the peasant women, who must work in the fields, keep aloof, and come in contact with men but little. Only the very poor, or those who are confessedly immoral, go about in public with unveiled faces. The evil effect of all this has been often described, and needs no comment.

Among nomads the case is different. The women of all races, so far as I know, both Mohammedan and non-Mohammedan, go about unveiled, and have a strong influence in the affairs of the community. Their relative strength of character is evident from the notable fact that when a Turkoman woman is married to a Persian, or a Kurdish woman to a Turk, the wife from the nomad stock, so it is said, usually rules the harem, and often rules the whole house. The universality of the contrast between the position of woman in nomadic and non-nomadic Mohammedan populations goes to show that the contrast is not the product of racial differences, but of nomadism.

The house of a nomad must of necessity be small, and can not contain two rooms, save under the most exceptional circumstances. A visitor must enter the room where the women are at work, or else the women must work outside; and there, of course, they can not be prevented from being seen by men other than those of their families. Then again, at the time of migrations there are no shelters left standing, and the women can not possibly be kept concealed. Moreover, they can not be made to veil their faces. No one can work with a cloth hanging down over her face. The village woman bakes and brews and washes, and milks her few sheep and goats in the seclusion of her own courtyard, where she can throw off her veil in the assurance that no strange man will see her. The nomad woman must work in semi-publicity, and can not be bothered with a troublesome veil, especially when both hands are more than occupied in milking some of her many sheep. Accordingly, while the Khirghiz woman is very particular about her headdress, she makes no attempt to conceal her face. She is in the habit of meeting strangers, whether men or women, and she does it modestly, though without timidity. Indeed, she makes a most admirable hostess. Her freedom from seclusion does much, both morally and mentally, to elevate her above her less fortunate sisters of the villages.

Another side of nomadic life tends to strengthen the character of the women. They are obliged to rely more or less upon themselves, and to take the initiative at times. In their care of the flocks and herds, it often happens that the men are all far away throughout the whole day, and at

certain seasons, when the grass must be cut in the valleys, many of them are far away for several days. At such times the women are responsible for everything. I have come to an encampment of seven or eight tents where no one was left except a few girls and one or two old women. The smaller girls, not unnaturally, were afraid of us; but the newly wedded wife of the chief man, a pretty girl of sixteen, entertained us most graciously, and by the time that her husband and the other men arrived, had supper ready for them and us. A veiled village woman would have screamed and run away at our approach. Besides all this, the occupation of the men with the horses and larger animals leaves to the women the care of the sheep when the flocks are driven home at evening. And, finally, it is always the wife who has the responsibility of taking down and packing the kibitka and setting it up in a new place, while the husband takes care of the herds. All these differences between the women of Tian Shan and those of the villages are the direct results of nomadism, and all of them tend to make the Khirghiz wife stronger, more capable and more self-reliant, and hence a better mother.

In view of all this, is it going too far to say that the relatively free, warm-hearted and affectionate spirit shown by the Khirghiz in their relation to one another is, in part at least, a geographic fact, the result of physical surroundings? In Karategin, at the eastern corner of Bokhara, I had a most pleasant glimpse of the inner life of a Khirghiz family. As we entered the village of Kichik Karamuk, I spied a villager making a rude sledge of the sort which the semi-agricultural Khirghiz use for hauling grain and hay, and style "arbas," or carts. Of course I wanted to photograph it, and told my servant Sherif to ask the carpenter to sit out farther into the light. Sherif, for some reason that I did not catch, said that it was impossible, but as another servant put the man in the right place, I took the picture before asking questions. The sledge-maker proved to be Sherif's brother, whom he had not seen for seven years. Out of sheer politeness the brothers remained silent till the picture was finished, then they embraced each other gently, as wrestlers might clinch before a struggle, first on this side and then on that, repeating very often and very fast the greeting, "Salaamet, salaamet, salaamet" ("Peace to you, peace to you, peace to you"). Later I saw Sherif meet another brother, the oldest of nine, and an older sister, who had been like a mother to him. The gray-bearded man, who was some twenty years older than Sherif, literally fell on his brother's neck and wept. The story of the Prodigal Son seemed very real just then. Meanwhile the wet-eyed sister stood silent till her turn came. As she fell on her brother's neck she wept aloud for a moment,

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and then, still clinging to him, began to chant a song of thanksgiving; and so she continued for some minutes, first weeping and then singing. Feeling out of place, I went into the kibitka and sat down on the floor. After me came a chubby little urchin of three, with a rosy, dirty face and a single scanty garment. A vague idea possessed him that some one had come whom he must welcome, so with a charmingly friendly smile he came and put his fat arms around me.

In this sketch of the Khirghiz I have tried to take some of the chief facts of their life and character, and to show how they are related to the physiographic facts of the Tian Shan plateau. Beginning with the grosser, more material aspects of life, it appears that the nomadic pastoralism of the Khirghiz is due to the climate and vegetation of the region that they inhabit. On this is dependent the form of their houses, furniture, utensils and dress, which in turn leads up to and determines the nature of their art. Again, the food of the Khirghiz is narrowly limited by the nature of their occupations, and this in its turn controls the large number of habits which center about the necessity of taking nourishment. Another line of thought leads from the frequent movements of the Khirghiz to the character of their hospitality and to their politeness. Once more, the hardships of the nomadic life result in certain mental and moral traits, such as bravery, hardihood, and, unfortunately, laziness. Finally, the conditions of nomadic life determine the position and character of the Khirghiz women, and lead to certain of the higher moral traits, such as morality in the stricter sense, self-reliance and even family affection.

USE OF GEOGRAPHICAL READERS.—1. The geographical readers should be used in connection with the text-book in geography to supplement the work there given.

2. An excellent way in which to use them is for the teacher to place topics on the board with references to different books used. As soon as pupils are able to do without the references these should be omitted, and the pupils should use the index of the book instead.

3. Some parts of the text not important enough to be studied may be read in class. A single book is often sufficient for such reading.

4. Only such parts of the geographical readers should be used as will serve a definite purpose. Other parts should be omitted.

5. Places should be located on the maps or globes as the study proceeds. Some teachers may prefer to have all pupils use geographies or globes for this work while one reads; others to have one pupil stand at the large map and locate the places described.—*Course of Study, Elgin, Ill.*

NOTES

NORTHERN OHIO GEOGRAPHY AT THE N. E. A.—The meeting of the National Education Association at Cleveland, Ohio, June 29 to July 3, will bring together many teachers, among whom there will be a large number interested in the geography and the industries of the Forest City. There will be afforded ample opportunity, by means of various excursions, to see some of the typical industries and to visit places of general geographic interest. Arrangements are being made with many of the great shops, mills and manufactories to open their doors to the members of the National Education Association wearing membership badges. As these establishments are many of them the largest of their kind and represent a great variety of manufacturing methods, much may be learned on these visits which will be of special value to the great number of teachers who are concerned with the industrial and vocational training of the children of the public schools.

In northern Ohio there is a network of steam and electric roads on which the service is cheap and convenient for rapid travel, while the boat lines offer many trips along the shore and to the various islands of Lake Erie. A great variety of enjoyable trips may be taken by the five finely equipped interurban lines out of Cleveland. Amusement parks, lake shore beaches, pretty little villages, college towns, river glens, beautiful lakes, the garden and fruit lands and vineyards of northern Ohio, all form numberless attractive destinations. To the east by the Cleveland, Painesville and Eastern trolley line are Willoughby, Mentor, the former home of President Garfield; Painesville, the location of Lake Erie College; and Ashtabula with its great harbor and ore docks. Southeast, by the Eastern Ohio Traction Company, are picturesque Gates Mills and Chagrin Falls, Punderson and Bass Lakes and Chesterland Caves. By the Northern Ohio Traction Company one may reach Canton, the home of the late President McKinley, where the McKinley Memorial is located; Meyers Lake; Akron, the seat of Buchtel College; Bedford Glens, Boston Ledges, Cuyahoga Falls, Silver Lake, Crystal Lake, Summit Lake. Oberlin with its famous college, Wooster with its university, Berea with Baldwin University and German-Wallace college are on the Cleveland, Southeastern and Columbus trolley line. The cities of Norwalk and Elyria are on this line, as well as North Amherst, with its famous sandstone quarries, Puritas Springs and Rocky River. The Lake Shore Electric Railroad runs between Cleveland and Toledo along the lake shore. On this line is Lorain, Sandusky and Rock River.

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The Central Association of Science and Mathematics is arranging a special excursion by boat to Kelley's Island and Put-in-Bay.* It is planned to spend ample time at Kelley's Island to see the glacial features and Inscription Rock. There will be an opportunity at Put-in-Bay to visit the various caves and other points of special interest.

If it is desired to visit several of the various geographic regions about Cleveland, the following suggestions will be of service in directing attention to the important areas, and the brief descriptions will indicate what may be found in the various localities. In attempting field work one must have the accurate contour maps issued by the United States Government for the entire southern shore of Lake Erie from Toledo to Buffalo. A postal card sent to the Director of the United States Geological Survey, Washington, D. C., asking for the index map of Ohio, will bring a small map showing all the sections of the state that have been accurately surveyed. These relief maps are printed on sheets 18 x 13 inches and show a district of about 236 square miles; they cost five cents each, or three cents each when one hundred or more are ordered. On the maps all the highways, railroads, villages, etc., are printed in black, while the lakes, rivers, canals, etc., are in blue, the elevations of various places are printed in brown figures, and by the contour lines the altitude of any point can be determined. The following list of sheets from Ohio is suggested as offering a suitable guide in selecting some material for a few days' study in the field: Sandusky, Massillon, Put-in-Bay, Akron, Cleveland and vicinity, Oberlin, Kent, Mentor, Conneaut, Ashtabula, Berea, Chardon, Perry, Cleveland, Garretsville.

If the maps are cut in small squares and mounted with paste on good muslin, they are easily folded and carried in the pocket. In starting on a trip, it is well to plan carefully all the details and select the roads from the maps. If there are several members of the party, a collection bag for rocks, a case for plants, and several good cameras should be a part of the outfit. The camera is indispensable on a vacation trip, and many of the views will later furnish excellent lantern slides for presening regional geography to the student. The suggestions which are outlined below embrace only the more striking features and in the limited space are necessarily very brief.

*It is planned to charter a boat, and about six hundred persons must be secured. Fare is $1.00. Correspondence should be addressed to Franklin T. Jones, president of the Association, University School, Cleveland, Ohio. The local committee of the N. E. A. Department of Science Instruction is planning on various excursions. For information, address any member of the committee, Dayton C. Miller, chairman, Cleveland, Ohio; George Eisenhard, George R. Twiss, Herbert C. Wood and Charles F. Dutton.

The Sandusky region west of Cleveland is a splendid type of an embayed plain with drowned river channels and great stretches of encroaching marshes. Several days could be spent in this vicinity, using the large hotel at Cedar Point as headquarters. It is nearly seven miles from the end of Cedar Point along the shore to the land, and there are a great variety of beach and shore features, including wave cutting, formation of sand ridges, bars, spits and dunes. While the land has been sinking, Cedar Point has increased in length and has been built over and buried some of the former river channels which are easy to trace.†

The islands northwest of Cedar Point afford a chance to see some of the erosive effects of the great ice sheet upon the bed-rock.

At Kelley's Island, easily reached by boat from Sandusky, the corniferous limestone has been deeply grooved; some of these grooves are five feet in depth and ten feet wide and have been preserved by the Western Reserve Historical Society of Cleveland. Some one has suggested that the tortuous grooves have been caused by a sub-glacial stream carving channels which were occupied later by the ice which smoothed and polished them. The straight single grooves have their origin in the cutting of the limestone by very hard rock in the lower part of the ice; some of these are very broad and are fluted and compounded in various ways. Kelley's Island has been for years the Mecca for students of glacial geology, and in the famous Inscription Rock which rests on the south shore the archæologist finds a romantic story of the Indian tribes which formerly held this ground. Inscription Rock lies on the south side of this island about eighty rods east of the steamboat landing. The rock is thirty-two feet greatest length and twenty-one greatest breadth, eleven feet high above the water in which it rests. It is a part of the same formation as the near-by bed-rock of the island, from which it has been "plucked" by glacial action. The top presents a smooth and polished glaciated surface, and upon this the inscription is deeply cut. Schoolcraft's *Indian Antiquities* says: "It is by far the most extensive and well sculptured and best preserved inscription of the antiquarian period ever found in America."

The Put-in-Bay group, consisting of North, Middle, and South Bass, Rattlesnake, Green and Sulphur islands, have much of interest in caves, deposits of calc spar, native sulphur, celestite and numerous sink holes. The bed-rock is the water-lime, containing fossils of many of the lower reptiles. On South Bass is Put-in-Bay, the famous summer resort, and the island has many caverns dissolved out of the rather porous limestone.

†*The Formation of Sandusky Bay and Cedar Point*, by Prof. E. L. Moseley, Vol. 4, Part 5; Proceedings of the Ohio Academy of Science.

"Perry's Cave" is the largest one on the island and was once an underground channel which even now leads to the lake. The water of this cave rises and falls with the fluctuations in level of Lake Erie. The walls have stalactites, and in parts of the cave they are under water, showing the gradual sinking of the land. "Crystal" cave on the same island is completely lined with large crystals of celestite. This mineral is rather rare and the islands of this group enjoy the distinction of having the largest deposits in the world. One of the group contains so much of the mineral that it is frequently called Strontian Island.

The Oberlin and Berea contour maps, when placed together, show the ridges or beaches of the former glacial lakes which existed at a higher level than that of Lake Erie. The old beaches are ten to fifteen feet in height and roughly parallel with the present lake shore. The track of the Cleveland, Elyria and Western electric road is on the crest of the Middle Ridge, just east of Elyria, while five miles to the east the road changes to another beach called the Butternut Ridge. In the vicinity of Elyria the beaches of Lake Warren, Whittlesley and Maumee are near together and convenient for field study. The North Ridge, about four miles north of Elyria, is the well-developed beach of Lake Warren which can be easily traced across Ohio; passing through Elyria is the Belmore beach of Lake Whittlesley, and four miles south is the double-crested beach of Lake Maumee. The industries of this particular section might prove of interest to some students of geography. At Lorain are very active shipyards, steel and iron mills and the largest steel-tube mill in the world. At North Amherst the stone quarries are worked on a very extensive scale and have supplied for many years a gray sandstone which is famous for its quality, and the quantity seems to be inexhaustible. The quarries at Berea supply an excellent quality of grit stone which is manufactured into whetstones and various kinds of grindstones. The small falls at Elyria and Olmstead are good illustrations of the manner in which almost all the streams of the northeastern part of Ohio have cut back their bed since the glacial period. A little exploration west of the mouth of the Rocky River along the shore of Lake Erie will reveal the buried pre-glacial mouth of the river. The pre-glacial channel, which is filled with an hundred feet of glacial drift, has been traced from Lake Erie southward, passing east of Berea. The present course of Rocky River crosses this buried channel west of Kamms and near Binola. This river has several interesting illustrations of "cut off" spurs, the best of which are the two "islands" standing on the flood plain near Olmstead.

The Kent, Akron and Cleveland map sheets have areas equally as

interesting as the various places above noted. The Cuyahoga River, called "cuyahaga" or crooked river by the Indians, is a source of much material for the study of the history and the geography of the Western Reserve. The river has the shape of a great "U" with its source thirty miles east of the mouth in Geauga County in the bed-rock of the carbonifereous conglomerate, and the great bend of the river is a short distance north of Akron. The conglomerate consists of masses of snow-white pebbles of quartz firmly cemented together. It is a rather porous rock, but does not weather rapidly, and to-day it forms many of the hilltops in northern Ohio. The resistant character of the conglomerate causes it to form high bluffs and ledges. The Thompson, Nelson and Boston ledges are of this formation and range from forty to eighty feet in height. This rock is also well exposed near the source of the Grand River at Parkman, which is west of the Cuyahoga's headwaters, and to reach Lake Erie the Grand flows almost around the source of the former river.

The Cuyahoga valley in the upper part of the river at Burton is marshy and shallow. Its features are so entirely different from what would be expected from the conditions in its lower and middle course, that it is difficult to recognize it as part of this stream. The upper course of the Cuyahoga has been determined by glacial deposits, which caused the stream to flow south, and near Akron it was forced west into a deep pre-glacial valley. In getting into this old valley, the river descends about two hundred feet in three miles and has cut a narrow deep gorge of over three miles in length at Cuyahoga Falls. At some places in this gorge the walls are quite near together, while the softer rock beneath the top ledges has been worn away. In early pioneer days, if we can believe the story concerning Brady's Leap, the ledges on the opposite sides of the gorge were about twenty-two feet apart, but at the present time its narrowest place is over forty feet. The water at the falls is checked by a series of dams for water power, which is used in a limited way, and the early prophecy that this was to be in the future the Lowell of the West has not been fulfilled. It is now a place easily reached by electric cars from Cleveland, and much visited for its beauty in the series of small falls, the high ledges and the picturesque arrangement of the small mills along the stream.

It is between the Falls and Akron that the river makes the great bend and turns north. The pre-glacial valley in which it flows to the north is rather narrow and deep. This valley to-day is partly filled with silt and glacial gravels, so the present river is not cutting on the old stream bed, but is removing the material which covers it. The extent and the depth of this old valley have been determined by the many wells that have been

drilled for gas, water and oil. At Akron glacial material fills the bottom of this valley to the depth of over three hundred feet, and it was partly this deposit that diverted the river to the north. In various places between the Falls and Cleveland the sides of the pre-glacial valley come quite near together and often form rapids or falls. At Boston the valley is not more than half a mile wide, and its sides are one hundred to one hundred and fifty feet above the river, which is cutting at the deposits of gravels and silt which are two hundred to three hundred feet deep. The small branches of the river are short and swift, cutting narrow and deep ravines in the soft sandstones and shales of the valley sides. In many of these it is possible to find a complete rock section. In the Brandywine, the lower gray rock is the Erie shale, which forms the extensive outcrops on the shore of Lake Erie; above it is a small layer of the black, bituminous, Cleveland shale, and still higher is the red Bedford shale. On top of the shales, and forming the projecting ledges, is the hard Berea sandstone where the Brandywine creek causes a small but splendid fall forty to fifty feet in height, and supplies power for a small mill. Splendid views of the river to the south may be obtained from the high lands north of Chaffee; here the valley is less than half a mile wide, and the lines of railroad, highways and canal are forced very near the water's edge.

The appearance of the Cuyahoga valley in pre-glacial time was quite remarkable in that it was narrow and so deep. At Boston the old river bed was at least two hundred feet below the present one, while at Willow there is a difference of over two hundred and fifty feet between the river now and in the past. In the city of Cleveland the drilling of many wells has clearly revealed the bottom of the old valley. It passes through Newburg, where the old river bed is four hundred and seventy feet below the present level of Lake Erie, to near the corner of Bratenhl and Girard avenues, where it is five hundred and twenty feet or more below the lake level. The general belief is that the pre-glacial stream drained a large part of the country south of Cleveland into a larger stream which flowed to the west in the present bed of Lake Erie.

The Grand River, partially shown on the Ashtabula, Chardon and Mentor maps, flows for more than thirty miles parallel to Lake Erie. Its northerly course is through the old Monongahela drainage system and on the retreat of the ice; a slight moraine blocked its return to Lake Erie and diverted it westward where it reaches the lake near Painesville. The pre-glacial channel of this stream is near Geneva. South of the village of Madison the Grand has eroded a narrow gorge some two hundred feet deep and in places less than a tenth of a mile in width. The early pioneers

called this part of the stream the "Grand Canyon." At Fairport the river formerly flowed through the great Mentor swamp into Lake Erie, but the retreat of the lake shore under the attack of the waves, combined with the lateral cutting of the river, has formed an open channel to the lake, and about four miles of the river has been cut off. Little Mountain, a flat knob of conglomerate, and one of the highest places in northern Ohio, is easily reached by wheeling from Willoughby.

WHAT'S NEW IN AFRICA.—In most courses of study in geography, Africa is the last of the larger grand divisions to be studied. The question arises whether we shall treat this country as we have previously taught North America, *i.e.*, by the usual method of instruction and recitation in surface, climate, etc., or whether we can not find an easier and more pedagogic way of approaching the study of this important part of the earth's surface.

In the first place, pupils that have previously studied North America, South America and Eurasia, should know how to read a map as easily and as correctly as they read a primer. They should know how the varying heights of mountains, the direction and volume of rivers, and the general topography of the country are indicated. In short, the pupil should have acquired the habit of rapidly translating the printed map into clear ideas of surface and drainage, and of expressing these ideas in good English. Presuming this sort of knowledge as an apperceptive basis, a map is all that is required to teach the physical features of Africa. There is nothing new excepting the names of mountains, rivers, etc.

Again, the climate of Africa conforms so closely to that of corresponding portions of South America and Asia, that previously acquired knowledge will serve as a basis for study or instruction. At this stage the pupil should know how to translate position in zones, mountains and plains, winds, and coastal lowlands, into the corresponding climatic terms of hot, cold; wet, dry; healthful, unhealthful. So far, then, as general climatic conditions are concerned, one or two lessons should suffice to give the pupil a fair knowledge of the climate of Africa. The only exception to conditions previously studied is the climate of the Sahara, and this tract can be made the subject of a special lesson.

Thirdly, the productions and corresponding industries are closely enough related to those of southern Europe and South America to form a satisfactory basis for this portion of the work. Wheat, cotton, gold, diamonds, timber, wool, and the semi-tropical fruits are old acquaintances found under precisely the same conditions and surroundings as in the other grand

divisions, while the various species of palm, and the papyrus, seem to be the only novelties. With these, as with the climate of the Sahara, a lesson or two should suffice.

So far, then, we have found scarcely anything in the geography of Africa that differs to any great extent from the corresponding facts studied in connection with the other continents. When, however, we consider the country from the ethnological and historical viewpoints, everything is new and strange, and teachers and pupils are fortunate, indeed, that in the *people* of Africa they have a topic of absorbing interest. Whether we consider the Moors, the Arabs, the Egyptians, or the Kaffirs, as they exist to-day, or whether we study Egypt, the Barbary States, and the black race historically, there is a wealth of the most interesting material to present to the pupils' mind, not only as *new information,* but as additional food for mental development.

To conclude, it seems that in any study of the geography of Africa, the purely topographical conditions need take up little of our time or energies. Let us devote our attention to the novel and intensely interesting *human* conditions. The ancient Egyptian and the modern Bedouin mean far more to us than the Kong Mountains, and the emphasis in our teaching should be placed on Africa as the abode of peculiar peoples, with racial characteristics, manners and customs, and historical significance entirely different from those of any other portion of the globe.—*From The Teacher, May, 1908.*